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OPUNTIA PINKAVAE (CACTACEAE), A NEW SPECIES FROM ARIZONA AND UTAH

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ABSTRACT. A new species of octoploid, dry-fruited prickly-pear (*Opuntia* subgenus *Opuntia*), *O. pinkavae,* is described from the Arizona–Utah boundary region. *Opuntia pinkavae* is most closely allied with *O. aurea,* a dry-fruited endemic, although its gross morphology resembles that of *O. macrorhiza,* a fleshy-fruited species.

Key Words: Cactaceae, *Opuntia* subgenus *Opuntia, Opuntia pinkavae,* prickly-pear, dry-fruited prickly-pear, polyploidy, pollen

Study of the *Opuntia polyacantha* complex (Parfitt unpubl.) revealed an undescribed species from northwestern Arizona and southwestern Utah. The name honors Dr. Donald J. Pinkava of Arizona State University, who brought modern biosystematic methods to the study of species-level relationships in the taxonomically challenging genus *Opuntia.*

Opuntia pinkavae Parfitt, *sp. nov.* (Figure 1). HOLOTYPE: USA, Arizona: Mohave Co., northwest of Bulrush Canyon south of Pipe Spring, 1400 m, $n = 44$, 30 May 1980, *B. D. Parfitt 2874* (ASU 111287!).

A *Opuntia macrorhiza* fructis siccis, perianthio magenteo-roseo, cladodiis interdum minute pappillatis, et chromosomatum numero octoploideo differt. A *O. aurea* spinis 1–4 per areolam in 20–50% distale areolarum, perianthio magenteo-roseo, chromosomatum numero octoploideo, et habitatione graminosa differt. A *Opuntia erinacea* (var. *erinacea* et var. *hystricina*) spinis tantum 1–4 solum in areolis distalibus caulis, spinis fructorum plerumque absentibus, cladodiis interdum papillatis, et chromosomatum numero octoploideo differt.

Low shrub with ascending to prostrate branches, 10–25 cm tall. Stem segments narrowly to broadly obovate, flat, glabrous or sometimes very minutely pubescent with erect papilla-shaped trichomes; terminal segments not readily detached, 6.5–15 cm long, 3–11 cm wide, thickness generally much less than half the width; areoles about 15–20 mm distant; rows of areoles transversing

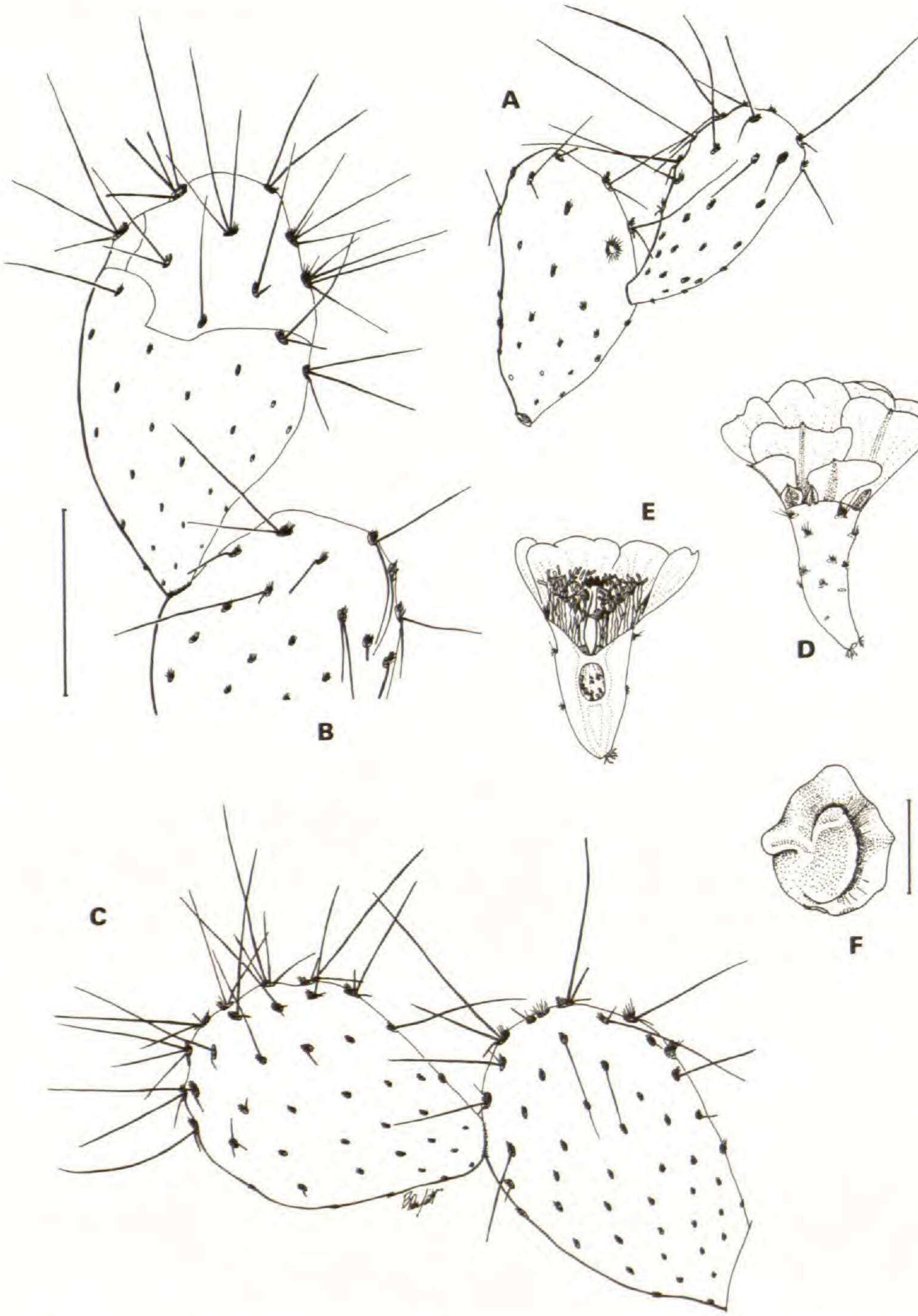

Figure 1. *Opuntia pinkavae:* A–C, stem segments; D, flower; E, flower, longitudinal section; F, seed. Scale bars: A–E, 5 cm; F, 5 mm. (A and D from *Brown 851 & Parfitt*; B and F from *Parfitt 2874* (holotype); C from *Brown 657 & Parfitt*; E from *Parfitt 3958 & Roberts.*)

stem segments (4–) 7–8. Spines occurring in upper 20–50 (–70)% of the areoles; major spines 1–3 (–4) per areole, the longest (3.5–) 5–7 cm long, 0.7–0.8 (–1) mm in basal diameter, descending to porrect, yellow-gray to white-gray, occasionally brown in basal half; minor spines (spines less than one-fourth the length of the longest spine in the same areole) 0–1, present in areoles with fewer than 3 major spines, 2–16 mm long. Glochids conspicuous, protruding 2–4 mm, forming a very dense crescent at apex of the areole, the sides of the crescent sometimes closing in and almost forming a column. Flowers 4.5–7.5 cm long; perianth magenta-pink, 2.5–3.5 cm long; filaments yellow to magenta; style white; stigma lobes green. Pollen dodecaporate, apertures smooth, margos semi-tectate, finely reticulate or nearly punctate with baculate lumina and columellate muri; tectum of the tetragonal, non-apertural faces punctate. Fruit 2–2.5 cm, dry; areoles (8–) 12–17; spines 1–4 per areole, 4–15 mm long, occurring mostly in upper areoles. Seeds 6.5–8 mm in maximum diameter; raphe 1.5–2 mm wide from embryo chamber to margin of seed. Chromosome number $2n = 8x = 88$ (Pinkava and Parfitt 1982, as *O. erinacea* var. *utahensis*; Parfitt unpubl.).

PARATYPES: **United States.** ARIZONA: Coconino Co., House Rock Valley, N of Rock Canyon, *Parfitt 2859* (ASU!); 1 mi N of Fredonia, *Brown 651 & Parfitt* (ASU!); Mohave Co., 1.2 mi N of hwy 389 on road to Moccasin, *Brown 657 & Parfitt* (ASU!); W of Kaibab Indian Reservation, *Parfitt 3958 & Roberts* (ASU!); Main Street Valley, W of Hurricane Cliffs, *Palmer & Hodgson 4620* (ASU!, DES); Navaho Trail near Hurricane Rim, *Gierisch 5132* (ASU!); 4.2 mi SW of Wolf Hole, *Brown 851 & Parfitt* (ASU!). UTAH: Washington Co., Warner Valley [SE of St. George], T43S R14W S7, *Gierisch 5049* (BRY!); 16 mi SSW of Hurricane on Fort Pierce Wash, *Earle s.n.* (ASU 108725!).

DISTRIBUTION, HABITAT, AND PHENOLOGY. *Opuntia pinkavae* is not uncommon in northwestern Arizona and extreme southwestern Utah at elevations of 1370–1560 m. The species occurs from the arid grasslands to the margins of pinyon-juniper woodlands. It is also found to persist in grasslands that have been damaged by excessive grazing and subsequent erosion. The substrate is usually fine, red sand; much less often it is limestone-derived loam. Flowering occurs in May and early June; fruits ripen in July.

TAXONOMIC RELATIONSHIPS. *Opuntia pinkavae* has long been overlooked as one of the many morphotypes included in Benson's (1969, 1982) concept of *O. erinacea* Engelmann & J. Bigelow

var. *utahensis* (Engelmann) L. Benson. Any dry-fruited prickly-pear with few, flattened spines on the stem segments, and few to none on the ovaries, was referred to *O. erinacea* var. *utahensis* by Benson (1982). The polyphyletic *O. erinacea* var. *utahensis sensu* Benson includes *O. pinkavae* and few-spined ecotypes of *O. erinacea* var. *erinacea* and var. *hystricina* (Engelmann & J. Bigelow) L. Benson. The type of *O. erinacea* var. *utahensis* represents a few-spined individual from within the range of *O. erinacea* var. *hystricina.*

Opuntia pinkavae is most closely allied with the yellow-flowered *O. aurea* McCabe ex Baxter, a species of deep sand in pinyon-juniper woodlands along a small portion of the Arizona–Utah boundary. The similarities of pubescence, pollen ultrastructure, and seed morphology indicate a close relationship between the two species. *Opuntia aurea* differs in having the perianth yellow (without red or pink), stem segments spineless (rarely with a single short spine in one or two areoles), and hexaploid chromosome number ($2n = 6x = 66$; Pinkava et al. 1973; Pinkava and Parfitt 1982; Pinkava et al. 1992; Parfitt unpubl.). Stem segments of *O. aurea* are very minutely papillate, the trichomes visible at magnification of 25× or greater. In about two thirds of the known populations of *O. pinkavae* some individuals have similar papilliform trichomes. One population of *O. pinkavae* east of the Kaibab Plateau has many individuals almost spineless (e.g., only 3 spines on one segment), further suggesting relationship with *O. aurea.* Benson's (1982) remarks on hybridization between *O. aurea* and *O. erinacea* var. *utahensis* apply to *O. aurea* × *O. pinkavae.* Hybrids and backcrosses between the two species are known (Parfitt unpubl.) at the interface between their respective pinyon-juniper and arid grassland habitats.

Opuntia pinkavae resembles *O. macrorhiza* Engelmann in habit and gross morphology of the stem and spines. However, *O. macrorhiza* has fruits fleshy, perianth yellow with a red base, stem segments always glabrous, tetraploid chromosome number ($2n = 4x = 44$; Pinkava et al. 1992; Parfitt unpubl.), and pollen with foveolate or large-pitted non-apertural faces, and margines with broad, strongly baculate lumina. The tuberous roots for which *O. macrorhiza* was named have not been observed in *O. pinkavae.*

Opuntia erinacea var. *erinacea* and var. *hystricina* occasionally occur within a few kilometers of *O. pinkavae.* They are, however,

very spiny tetraploids (Pinkava et al. 1973; Pinkava and Parfitt 1982; Pinkava et al. 1985; Pinkava et al. 1992; Parfitt unpubl.) with very spiny fruits, and bear little resemblance to *O. pinkavae*. On the eastern side of House Rock Valley, Coconino County, Arizona, the geographic distributions of *O. pinkavae* and *O. nicholii* L. Benson overlap by about 0.5 km. Specimens from throughout the range of either species are distinctive and not at all likely to be confused. Although some individuals of *O. nicholii* are heptaploid and some octoploid at a site about 27 km east of the geographic range of *O. pinkavae* (Parfitt unpubl.), *O. nicholii* is hexaploid throughout most of its geographic range (Pinkava et al. 1977; Parfitt unpubl.), including the area of sympatry. There is no evidence of interbreeding between the two taxa. *Opuntia phaeacantha* Engelmann, a fleshy-fruited hexaploid, is the only other *Opuntia* species occasionally occurring with *O. pinkavae*.

Plants of *Opuntia pinkavae* in the Warner Valley of Washington County, southwestern Utah, are often spineless or nearly so and pink-flowered, and have been treated as a variety of *O. basilaris* Engelmann & J. Bigelow—var. *woodburyi* W. Earle (1980). Plants in that population share a greater number of morphological characters with *O. pinkavae* than with *O. basilaris*. Furthermore, *O. basilaris* is diploid (Pinkava and McLeod 1971; Pinkava et al. 1973; Pinkava et al. 1977; Parfitt 1978; Takagi 1938; Sato 1958; Yuasa et al. 1973) and Warner Valley plants are octoploid ($2n = 88$; Pinkava and Parfitt 1982, as *O. basilaris* var. *woodburyi*; Parfitt unpubl.). The name, *O. basilaris* var. *woodburyi,* was published for the Warner Valley plants without the required, specific indication of a holotype. It is, therefore, invalid (see Art. 37.1, 37.3 of Greuter et al. 1994). The Warner Valley plants are a robust, somewhat tuberculate-stemmed form of *O. pinkavae*.

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